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The Perspective of Science and Religion in High School Biology Teachers in Argentina, Brazil and Uruguay: a comparative study.

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Abstract

The relationship between science and religion has been marked by historically constructed movements of proximity and conflict. We have investigated how high school biology teachers from three countries with different relationships between State and religion, Argentina, Brazil and Uruguay, conceive the science-religion relationship. Uruguay has consolidated secularism, Argentina has an official religion and Brazil calls itself secular, but its secularism is only relative. Fifty high school biology teachers from each country answered the European BIOHEAD-CITIZEN data collection questionnaire, which investigates teachers' conceptions of biological evolution, health, sexuality, and other topics. The question used was "Should science and religion be separate?" Conflict, independence, dialogue and integration categories were considered in the analysis and the results were submitted to parametric testing. Most Uruguayan high school biology teachers tended to agree with the investigated question, with a lower ratio in Brazil, followed by Argentina. Uruguayan teachers tended to be more assertive in their agreement. The main category was partially confirmed as teachers from Uruguay, the country with a greater secular tradition, tended to agree with the separation between science and religion. In Brazil and Argentina, the category was not confirmed. In Brazil, a self-proclaimed secular country, high school biology teachers were more opposed to the separation between science and religion, while in Argentina, a country with an official religion, they supported the possibility of dialogue and integration between them. We concluded that the respondents felt that science and religion should be separate, but trends varied according to the historical and cultural religiosity features of the selected countries, with a partial influence of secularism on the responses.

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1. Introduction

This paper reports on some results from a larger doctorate comparative study of high school biology teachers' views on biological evolution in Latin American countries in relation to the State-religion relationship. Argentina, Brazil and Uruguay were selected for this study. The Argentinean Constitution establishes the Catholic religion as the country's official religion, while Brazil has a relatively secular status due to the influence of religion on politics and society as a whole and Uruguay has a well-established secular condition (Oro, 2008).

According to Franco (2000), comparison is a natural human trait; however, the history and culture of each country must be taken into account in educational research. Educational research may be driven by reflection on similarities; however, this study was guided by differences between the selected countries regarding State and religion relationships. Authors like Goergen (1991) highlight that in contrast to other areas such as economics and sociology, comparative studies in education are scarce and necessary. This investigation is an attempt to contribute to fill in the gap regarding teachers' views of the relationship between science and religion.

Barbour (1990) proposed four categories for the analysis of the conception of the relationship between science and religion: conflict, independence, dialogue and integration. These categories can be explored in the comparison of the teachers' conceptions. Coutinho and Silva (2013) outlined these four categories. In the conflict category, science and religion are seen as non-reconcilable and mutually exclusive. In this approach, science and religion are clearly separate, with one side considering itself to be the owner of the truth in detriment to the other, a view supported by radical atheist scientists and Biblical creationists. Also from the independence category, science and religion are clearly separate, because in this category each one is based on distinct traditions and forms of knowledge, with very little to say about each other since they have different methods, themes and languages, outside the scope of each other, and they should not overlap or interfere with each other. The third category, dialogue, admits some form of interaction between science and religion in a less rigid way. Science is considered not to need religion, but it may resort to its support and establish a dialogue with religion in the quest for answers. The gap in knowledge about the beginning of the universe completed by the existence of a Creator is an example under this category. Lastly, in the integration category, the borders between science and religion are flimsy, invoking "natural theology" to explain the existence of God, based on human logic rather than on religious experience. An example is the Intelligent Design hypothesis that the complexity of organisms only makes sense if one considers it to have been planned by an intelligent designer.

This study was conducted at a very special moment for Brazilian society, amid a change in its relationship towards religiosity. The last Brazilian census (IBGE, 2010) revealed a sharp growth in the number of Evangelicals and a drop in the number of Catholics. It also indicated an increase in another group with characteristics antagonist to Evangelicals, the self-titled non-religious. The self-titled non-religious may include atheists, agnostics and those who believe in God but follow no specific religion. According to Silva and Mortimer (2014), the growth of both these groups heightens the conflict of distinct points of view between science and religion in the classroom, especially concerning themes like the origin of life, the origin of humankind and biological evolution, and echoes both in society and politics as a whole.

2. Methodology

The research instrument used was the BIOHEAD-CITIZEN (Carvalho, 2004; Carvalho & Clement, 2007; Munoz et al., 2009) questionnaire, which was employed in a great European investigation project (Biology, Health and Environmental Education for better Citizenship – FP6-STREP CIT2-CT-2004-506015; 2004 - 2008) in which 19 European, African and Middle Eastern countries participated. This socio-cultural country comparative investigation project was conducted to understand the interaction between social context factors and teachers' conceptions of controversial issues such as evolution (specifically, human origin), sex education, health and environmental education. Therefore, this instrument is suitable for the objective of the present study. According to Carvalho and colleagues (Carvalho and Clement, 2007; Carvalho et al., 2012), the formulation of the questionnaire took into

consideration variations in the science and religion relationship among different countries. The teacher population sample of each country followed the same protocol proposed by Carvalho et al. (2008). The samples were considered satisfactory and the broadness of the questionnaire and time required for high school biology teachers to answer the questionnaire were taken into account. Barbour's (1990) four main categories, conflict, independence, dialogue and integration, were used in the analysis of the high school biology teachers' conceptions. Two of these categories, independence and conflict, favor the separation between science and religion, and two are against their separation, dialogue and integration.

The main working hypothesis is that the religiosity or secularism of a country interferes with high school biology teachers' conceptions of the relationship between science and religion. We expected that the more secular a country is, the more the high school biology teachers would tend to consider that science and religion should be separate. According to this hypothesis, Uruguayan high school biology teachers were expected to be more supportive of the separation between science and religion, in contrast to Argentineans; while Brazilian high school biology teachers were expected to reveal an intermediate position. Data were collected in the following cities: Buenos Aires, Argentina, Belo Horizonte, Brazil and Montevideo, Uruguay. These countries and cities were chosen because the Argentinean Constitution supports the Catholic religion, Brazil claims to be a secular country, but it is influenced by many factors, and Uruguay has a solid secular tradition.

The numbers of answered questionnaires were: Buenos Aires, 50, Belo Horizonte, 62 and Montevideo, 57. Therefore, the subsample size in each country was close to the subsample size of 50 teachers in the BIOHEAD-CITIZEN questionnaire pilot test (Carvalho et al, 2008). The same subsample size was used by Araujo et al. (2009) in a study involving Brazilian teachers.

The hypothesis was tested by hypothesis testing of two sample proportions with software Statdisk 9.1 (Triola, 2005). Due to the difficulty in obtaining a subsample size greater than 50, a slightly lower significance level of 94% ($p < 0.06$) was used so that significant differences between high school biology teachers' points of view in the three countries could be detected.

3. Results and Discussion

In the discussion of the study results, it is important to bear in mind the differences in the State and religion relationship between the investigated countries. As said above, Argentina fits within the group of countries with an official religion, Uruguay fits within the group of countries favoring separation between State and religion with some privileges for the Catholic Religion, and Brazil is a secular country, with no privileges for any religion (Oro, 2008). Nevertheless, the authors acknowledge that secularism is relative in Brazil and that it is more solid in Uruguay. Table 1, adapted from Oro (2008), shows the percentages of religious populations in the countries investigated.

Table 1. Religiosity in Argentina, Brazil and Uruguay. Source: Oro (2008)

Countries	Catholic (%)	Evangelic (%)	Others (%)	Non-religious (%)
Argentina	88.0	8.0	2.0	2.0
Brazil	73.6	15.4	3.6	7.4
Uruguay	52.0	2.0	11.0	35.0

It is important to point out that currently the number of Evangelists among Brazilians has increased, with an ensuing decrease in the number of Catholics and a growing influence in politics and society as a whole (Mariano, 2001). The strong prevalence of Catholics in Argentina is accompanied by a significant increase in the number of Evangelists over the last years. Lastly, the self-claimed non-religious in Uruguay completes the target population of this study.

Figure 1 shows the results of the respondent teachers from Argentina to question A51. A total of 70% of the respondents favored the separation between science and religion (52% totally agree plus 18% agree more than disagree), while 30% (20% totally disagree plus 10% disagree more than agree), supported some form of approximation between science and religion.

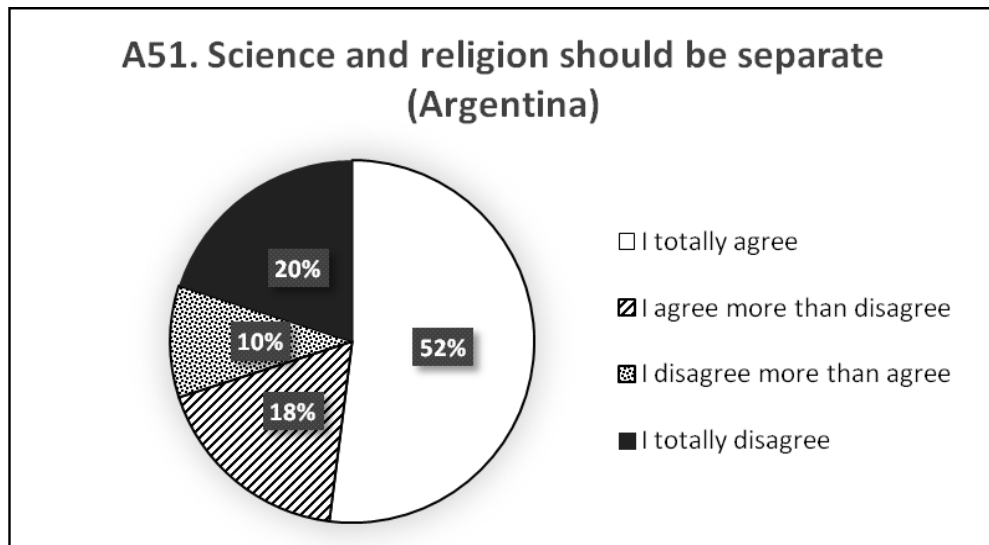


Fig. 1. Opinion of Argentinean high school biology teachers on the separation between science and religion.

Based on Barbour's categories, we can conclude that most of the Argentinean respondents supported the hypotheses of conflict and independence between science and religion. This point of view is closer to what Mahner and Bunge (1996) indicated as a variation of incompatibility between science and religion, especially when religious doctrines such as the Bible are interpreted literally. For them, these two fields are incompatible and non-reconcilable because they use different languages and methods. Souza et al. (2009) reported the rejection of themes that are at the heart of religious dogmatism, such as the origin of humankind and biological evolution, even among future high school biology teachers, which could explain the rejection of Barbour's categories that indicate a greater proximity between science and religion. For Coutinho and Silva (2013), this position may result in a major denial of knowledge in both fields. However, Colonetti and Sanches (2012) pointed out the importance of the separation between science and religion and the preservation of their distinct features, which may be an interesting strategy to silence those who propose that conflict is inevitable.

In contrast to Argentineans, Brazilians did not show a clear response tendency, since 52% of the respondents favored the separation between science and religion (34% totally agree plus 18% agree more than disagree) and 48% (30% totally disagree plus 18% disagree more than agree) supported approximation between science and religion (Figure 2).

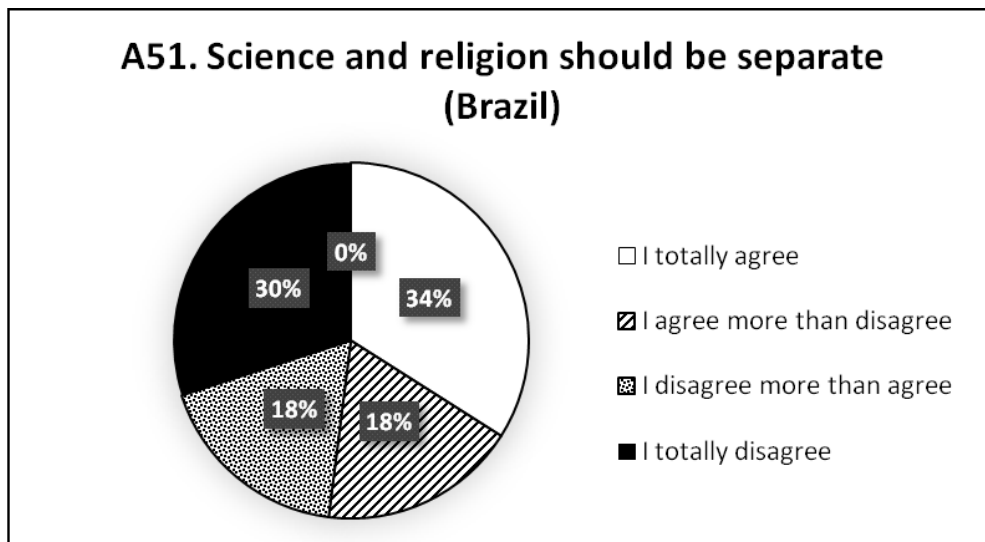


Fig. 2. Opinion of Brazilian high school biology teachers on the separation between science and religion.

The Brazilian high school teachers' data indicate that they are divided among Barbour's categories. Nearly half the respondents tended to support the categories of conflict and independence between science and religion, while the other half considered dialogue and integration possible. Among the countries analyzed, Brazilian teachers supported a greater affinity between science and religion. These teachers successfully dealt with the cultural clashes with their beliefs to accommodate both contradictory beliefs in their cognitive structure (El-Hani & Bizzo, 1999). This corroborates Silva and Mortimer's (2014) report of a strong tendency to accept the intelligent design hypothesis among Brazilians, closer to the science and religion integration hypothesis.

Figure 3 shows the percentages of responses to question A51 in Uruguay. A total of 73% of the Uruguayan respondents (59% totally agree plus 14% agree more than disagree), close to that of Argentines, supported the separation between science and religion, reflecting the secularism in Uruguay. A smaller percentage of the teachers supported the proximity between the fields: 27% (16% totally disagree plus 11% disagree more than agree).

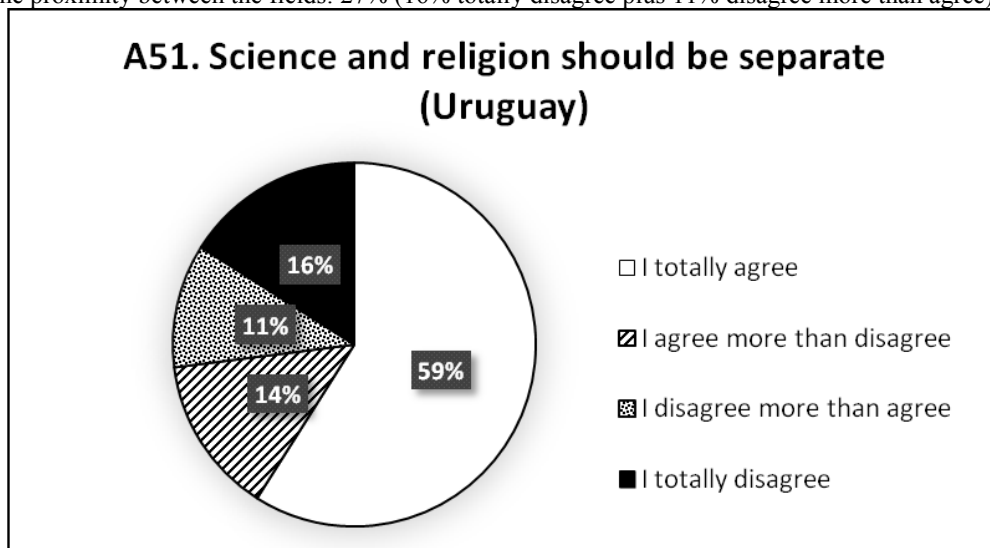


Fig. 3. Opinion of Uruguayan high school biology teachers on the separation between science and religion.

It is clear that most Uruguayan teachers fit Barbour's conflict and independence categories, as do the Argentinean teachers. This is a result expected from a country with a strong secular tradition and a significant atheist population. According to Mahner and Bunge's (1996), this view assumes science and religion to be separate, with different doctrines, methods and attitudes. A reasonable number of the Uruguayan teachers considered the approximation of science and religion possible. This was unexpected, given the secular tradition of their country; they successfully negotiated the cultural borders of science and religion, which was also reported by Sepulveda and El-Hani (2006).

Figure 4 compares the data from the three countries. It shows that most Uruguayan high school biology teachers supported the separation between science and religion. In Argentina, the difference between teachers who supported or not the separation of science and religion was low, still indicating a tendency to their separation. In contrast, Brazilian teachers were divided, standing apart from the two other countries with a significant number of high school biology teachers who considered the approximation between science and religion as being possible.

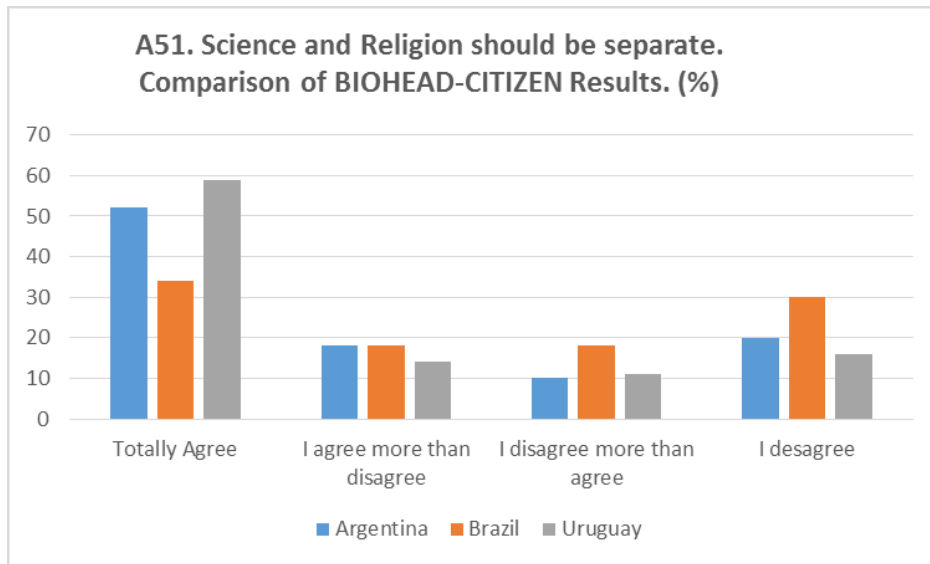


Fig. 4. Comparison of the opinion of Argentinean, Brazilian and Uruguayan high school biology teachers regarding the separation between science and religion.

The application of the hypothesis testing of two sample proportions at 95% of significance showed no differences among the countries, but testing at 94% revealed significant differences ($p < 0.06$) between Brazil and Uruguay, as well as between Brazil and Argentina in the "Totally agree" response. However, no statistical differences ($p > 0.06$) were observed between Uruguay and Argentina. Similarly, the other responses did not differ significantly between the three countries. Increasing the subsample size might reveal statistical differences between the countries.

Table 2 - Hypothesis testing of two sample proportions at significance level 6%.

A 51. Science and Religion should be separate - Brazil and Uruguay			
	p	P ₁	P ₂
Totally Agree	0.0064	0.4148	0.0830
I agree more than disagree	0.6100	0.0922	0.1613
I disagree more than agree	0.2777	0.0496	0.1901
I disagree	0.0631	0.0020	0.2864
p≤0.06			

A 51. Science and Religion should be separate - Uruguay and Argentina			
	p	P ₁	P ₂
Totally Agree	0.4735	0.1122	0.2508
I agree more than disagree	0.6029	0.1720	0.0977
I disagree more than agree	0.9042	0.1043	0.1185
I disagree	0.5986	0.1801	0.1016
p≤0.06			

A 51. Science and Religion should be separate - Brazil and Argentina			
	p	P ₁	P ₂
Totally Agree	0.0533	0.3558	0.0068
I agree more than disagree	0.9717	0.1396	0.1344
I disagree more than agree	0.2444	0.0438	0.1986
I disagree	0.2011	0.0467	0.2596
p≤0.06			

In general, high school biology teachers in the three countries tended to consider that science and religion should be separate, with a significant difference in the Brazilian sample. The difficulty to accommodate scientific and dogmatic knowledge was detected in biological science trainee teachers by Silva et al. (2014). In Brazil, many respondents proposed that science and religion are compatible. This is important in a context of relative secularism because religion may influence State affairs and educational policies (Cury, 2004). Brazil is marked by a strong religious view of the world and the teachers in the study may be seeking a compatible view of science and religion (Cobern, 1991). We must consider that in Argentina, there is a predominance of Catholicism, a traditionally non-radical religion in controversial themes. Secularism does not prevail in Brazil, which may be explained by the increasing number of Evangelicals, some of whom are quite radical in controversial themes and tend to seek a more very active role in several fields of society.

4. Conclusion

In conclusion, the hypothesis of the influence of secularism on high school biology teachers' views of the science and religion relationship was partial. Teachers from Uruguay, a more secular country, as well as from Argentina, tended to be more assertive about the separation between science and religion as compared to Brazil. Therefore, the hypothesis of the influence of state secularism on high school biology teachers' responses was rejected. The prevailing religious point of view of the respondents in Argentina, which has a stronger Catholic presence, could have favored a more critical point of view and the separation between science and religion. In contrast, the growing number of Evangelical religions in Brazil and their strong influence in society may have favored the responses of approximation between science and religion. We can also conclude that the teachers' religion may interfere in the responses, with Catholic high school biology teachers tending to separate science and religion, in contrast to Evangelical high school biology teachers. Further studies involving larger samples may contribute to understanding the influence of religion on the respondents' answers about the separation between State and religion. Finally, it is important to take into account Sepulveda and El-Hani's (2001) report that teachers' beliefs have an effect on classroom pedagogical praxis and that further research is necessary to unveil how teachers' views of science and religion influence the teaching of controversial themes.

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